Rubber Research Scheme (Ceylon).

Third Quarterly Circular

for

1927.

Reprinted from the *Tropical Agriculturist.*

September and October, 1927.

H. W. CAVE & CO., PRINTERS.

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of

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Notes

on

Rubber Manufacture.

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Mycological Notes (7).

Oidium Leaf Disease of *Hevea.*

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INTEREST has been aroused in Ceylon by the report that a leaf disease of *Hevea* has caused of late a certain amount of perturbation in Java. Enquiries addressed to the Department of Agriculture in Java have elicited the information that the unusually dry weather conditions of the last two years have led to an increase in the incidence of a leaf disease of *Hevea* in certain areas of that country. The disease in question is caused by a species of *Oidium* or powdery mildew; it has been known in Java for a number of years. As diseases of the type caused by *Oidium* are considered to be "dry-weather" rather than "wet-weather" diseases, it is of interest to note that the weather conditions associated with the reported increase of disease were abnormally dry.

The interest aroused by the report from Java has drawn more attention than usual to leaf disease of rubber in Ceylon, and reports have been received that certain estates are suffering from severe attacks. Investigation of such claims has shown the necessity for indicating clearly the symptoms and effects by which *Oidium* disease may be recognised, for damage caused by wind, rim-blights and root disease has been attributed in error to *Oidium*.

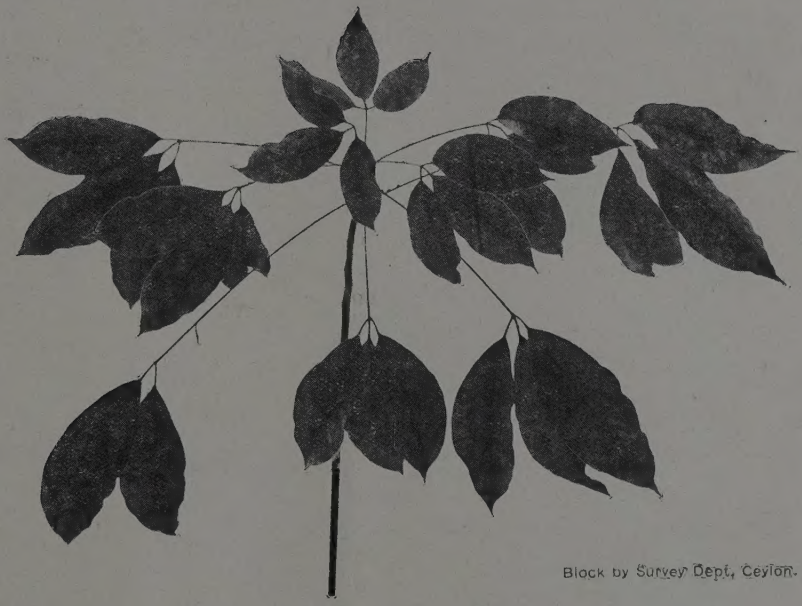
Hevea mildew, as *Oidium* disease has been called, attracted attention in 1925 for the first time in Ceylon, and articles on the disease were written by Stoughton-Harris (1) and Gadd (2). Since that time *Oidium* disease has become of common occurrence. Its effects are more marked than formerly and they appear to be more or less serious in certain districts and at certain elevations The best-known form of attack occurs on young leaves at the time of their early growth and rapid expansion. Their leaflets become discoloured, curl from the margins and fall, and examination with a lens discloses the white, powdery superficial covering of the fungus *Oidium*. This form of attack is the most serious because it causes defoliation, but it has been

found that trees partially or wholly defoliated in this manner put out fresh leaves and so recover. The latter, however, may or may not be attacked in turn at the time of unfolding.

Leaves which are older than the very young leaves mentioned above, but which are still in an immature state may also be attacked, but in their case the whole area of the leaf need not necessarily become diseased. Areas at the margin, tip or about the midrib may become discoloured; the leaves may or may not fall as the result of attack. If they remain on the tree, the healthy portion of the leaf continues to expand while the diseased area cannot do so, and the consequence is a malformation which is one of the most characteristic symptoms of *Oidium* disease in Ceylon. The distortion persists throughout the life of the leaf although the fungus may have ceased to be in a condition of active parasitism upon it. This second type of attack is not considered to be as serious as that on the very young leaves since diseased older leaves do not fall from the trees in the same large numbers as young leaves.

The symptoms enumerated above describe briefly *Oidium* disease as it has been known in Ceylon. The term "primary attack" may be adopted to indicate them. Primary attack is most prominent at the period immediately after wintering, and observations in Ceylon have tended to show hitherto that the attack is arrested when the leaves attain maturity. Recent investigations, however, have shown that this view may be erroneous and that the fungus may attack fully-developed leaves. The symptoms noted in certain cases are described below. In these cases, *Oidium* disease has occurred on mature leaves in the months of June and July, a fact which is not in accord with the view that the disease occurs in dry rather than wet weather. The South-West Monsoon of the present year has been of average intensity in the districts in which the attack on mature leaves has been observed.

The symptoms of this "secondary attack" or attack on full-grown leaves differ from those of primary attack. Irregular yellowish translucent spots are scattered over the surfaces of the leaves. Such spots are best seen when the affected leaf is held up to the light; they give the leaflets an irregularly mottled appearance. The accompanying photograph shows a typical appearance. In advanced cases the powdery mildew which is made up of the hyphae and spores of the *Oidium* can be discerned readily with a lens on the undersides of the spots. Seen under the microscope the spores are indistinguishable from those of the *Oidium* that is found in primary attacks. As the spots grow older, they turn purple-brown in colour and eventually dry up, forming irregular brown areas the centres of which may fall out and leave small irregular holes with a brown margin.



Block by Survey Dept., Ceylon.

Photo by *L. S. Bertus*

Photograph Showing Symptoms of "Secondary Attack" of *Oidium* Leaf Disease of *Hevea.*

In no case has secondary attack been noted to cause defoliation. In this respect it is less serious than primary attack. It may be wide-spread; on a certain estate recently inspected the majority of the leaves showed typical spots. *Oidium* disease appears to be more serious in its effects at mid-country elevations but that may be explained on the ground that attack in the low-country rubber districts is masked by the leaf and pod disease caused by *Phytophthora Faberi*.

The effects of a primary attack of *Oidium* disease are to be seen in the sparsity of the foliage. The foliage put forth by a tree after more or less complete defoliation as a result of *Oidium* disease may be poor and the leaves smaller and more yellow in colour than the normal. It is obvious that defoliation of this nature must be a considerable drain on the resources of the tree. On the other hand, damage caused by the secondary form of attack may not appear to be so serious. No defoliation is caused but a proportion of the leaf surface must cease to function in the processes of photosynthesis and, as the proportion of diseased to healthy area becomes greater, the effects of secondary attack may be more serious.

There are no records in Ceylon to indicate that *Oidium* disease causes a decrease in the yield of latex. It is possible, however, that the cumulative effects of consecutive attacks may result in a lowering of the vitality of the trees and a reduction in yield. This possibility should be borne in mind when considering treatment for the disease.

Diseases of the mildew type of other crops, for example, the grape-vine, have been controlled by spraying with Bordeaux Mixture or a similar fungicide. Spraying is a *preventive* measure and the essential for successful control of disease is that the sprayed surface should have a complete coating of fungicide in order that the parasite may be prevented from attacking and entering the plant tissues. It is obvious that in the case of primary attack of *Hevea* by *Oidium* such a condition can be fulfilled only by constant spraying, since the leaves at the time of attack are expanding and a superficial film of fungicide will remain complete only for a very short time. Satisfactory spraying for control of primary attacks with the present form of sprayers is therefore impracticable under Ceylon conditions. Once the leaves have reached their full-growth, however, a single spraying, if well applied, should be sufficient to control secondary attack. The secondary form of attack, however, is at the present time less serious in its effects than the attack on young expanding leaves.

Direct control, therefore, is hardly feasible in practice, and indirect treatment is indicated. It is a well-known agricultural principle that nitrogenous manures tend to increase the amount and better the condition of the foliage of plants, but there is no

record that rubber trees which are heavily manured with quick-acting nitrogenous manures are more immune or resistant to leaf disease than unmanured trees. There is little doubt, however, that such treatment results in a better cover of leaves *after* an attack of leaf disease. No experiments have been carried out to confirm this statement in regard to *Oidium* leaf disease but inspection of fields manured with nitrogenous manure and their comparison with similarly situated unmanured areas has demonstrated a marked improvement in the former.

From the above it may be concluded that since primary attack of *Oidium* leaf disease of *Hevea* is not directly and easily controllable under field conditions, indirect control should be attempted by cultivation and the application of quick-acting nitrogenous manures at or about wintering time. Badly affected trees may have to be rested. To control secondary attack spraying with Bordeaux Mixture at the time when leaves are just attaining maturity may be advised; in certain districts this spraying would serve the double purpose of controlling secondary attack of *Oidium* leaf disease and leaf and pod disease due to *Phytophthora Faberi*.

References.

1. Stoughton-Harris, R. H.—1st Quarterly Circular for 1925, Rubber Research Scheme (Ceylon), p. 8.
2. Gadd, C. H.—Year Book of Department of Agriculture for 1926, p. 22.

Notes on Rubber Manufacture.

Effect of Disinfectants on Scrap Rubber.

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A SAMPLE of scrap rubber was received recently which showed distinct signs of tackiness. On the estate from which the sample was sent, disinfectant is applied to the tapping cut on the day after tapping, but the scrap is not removed until the next tapping. It was suggested that the tackiness was due to the action of disinfectant on the scrap.

In order to test this point some fresh scrap rubber was divided into 4 portions, two of which were dipped in 10% Brunolinum Plantarium and hung to dry. The treated portions became distinctly darker in colour during the night. One treated and one untreated sample were kept in a shady place, and one treated and one untreated sample were placed in the sun for 12 hours. On examination of the portions exposed to sunlight it was found that the sample treated with disinfectant showed very considerably more tackiness than the untreated sample. The two samples which were kept away from sunlight were free from tackiness after several weeks. The test was repeated with a number of different disinfectants and in each case it was found that the scrap when exposed to sunlight became more tacky than untreated scrap.

It is concluded that scrap should be removed before applying disinfectant to the tapping cut, otherwise tackiness is liable to occur.

Tacky Spots in Crepe.

A sample of crepe containing red tacky spots was recently received. It was suggested by the sender that the spots were due to fungal infection, but chemical examination revealed the

presence of copper in the rubber. Presumably this originated from oil spots or minute chips of metal from worn bearings in the creping rollers.

Such cases of tackiness due to contamination with copper are not infrequently met with, showing that the danger of worn bearings is not always realised. Apart from actual tackiness it has been shown that 1 part of copper in a million of rubber causes distinct deterioration.

Enquiries are being made with regard to the feasibility of replacing bronze bearings in rubber rollers by cast iron or some other non-copper bearing metal.

Aluminium Coagulating Pans.

In June, 1925, 6 aluminium pans imported by the Research Scheme were put into use on an estate together with 6 new enamelled dishes, in order to compare the wearing qualities of the two. The dishes were recently examined and it was found that whereas the aluminium dishes were equal to new, all the enamelled dishes were chipped at the inside corners. Once this stage is reached corrosion of the exposed iron takes place rapidly and it can be prophesied that the useful life of the enamelled dishes will be finished in another year. The aluminium dishes referred to were of heavier gauge than those which are at present available in Colombo, but about 100 of the latter have been in use on the same estate for the past year and show no signs of wear except slight dents.

On an estate where formic acid is used as coagulant, aluminium dishes have been used during the past year and show only slight dents and pitting of the metal. It was suggested by a writer in Sumatra that aluminium dishes would corrode rapidly with formic acid, but a test carried out here using acid of twice the strength necessary for coagulation, indicates that it would take about 15 years for a dish to corrode through.

The aluminium dishes at present available locally are of low price and correspondingly light construction in order to compete with enamelled dishes. They can be expected to give considerably better service than enamel, but in the long run it would amply repay the Planter to demand heavier gauge dishes.

Methods of Using Para Nitrophenol.

In a report on the use of p.n.p. as a mould preventive (R.R.S. 4th Quarterly Circular for 1925) it was explained that it can be used in two ways.

1 An appropriate quantity can be dissolved in the acid used for coagulation and thus introduced into the latex.

2. The sheets after rolling and washing can be soaked in a dilute solution of the chemical.

It was pointed out that the first method is usually adopted in Malaya where coagulation is carried out in tanks. In Ceylon, however, after addition of acid, the latex has to be transferred to pans or troughs, and there is a danger that clotting might set in before this is complete, thereby spoiling the appearance of some of the sheets. The second method was therefore recommended for adoption in Ceylon.

Experience has shown that the Malayan method can be used successfully on certain Ceylon estates where coagulation takes place slowly. In dry districts, such as Kegalle and Matale, coagulation is rapid and it is unlikely to be satisfactory. It has the advantage of being more "fool-proof" than the soaking method. Once the p.n.p. has been added to the acid there is no fear that some of the sheets have escaped treatment. It is suggested that estates should experiment with this method of treatment and adopt it if satisfactory.

The simplest procedure is to dissolve p.n.p. in undiluted acid (acetic) in the proportion 1 lb. p.n.p. to $4\frac{1}{2}$ lb. strong acid. The p.n.p. dissolves freely but it is advisable to crush it thoroughly before mixing. The acid is then used in the ordinary way but it must be remembered that by addition of p.n.p. the acid has become diluted, its strength being approximately 85%. Thus if the dose of acid used for coagulation was previously 6 oz. per Shanghai jar, the dose of mixture will be 7 oz. There is no objection to a carboy of acid being mixed at one time, as the p.n.p. does not deteriorate in the acid mixture.

If formic acid is used for coagulation the proportion is 1 lb. p.n.p. to $2\frac{1}{4}$ lb. 90% formic acid. Some difficulty will be found in dissolving this large amount of p.n.p. in the acid, and it will probably be found simpler in the case of formic acid to dissolve the requisite amount of p.n.p. (1 part p.n.p. to 800 parts dry rubber) in the water used for diluting the acid. If p.n.p. is dissolved in the strong formic acid it should be noted that the strength is thereby reduced from 90% to 67%.

Ventilation of Air-Drying Sheds.

Successful air-drying of crepe depends on efficient ventilation of the drying shed, but it is the writer's experience that this point does not always receive the attention it deserves. Every thousand pounds of wet crepe contains approximately two hundred pounds of water. In order to dry the rubber, *i.e.*, remove this amount of water, it is calculated that a minimum of one and a half million cubic feet of air is required.* This is the

* On the assumption of an average temperature of 85°F. and an average relative humidity of 85%.

theoretical figure assuming that every particle of air comes into contact with the rubber and takes up the full amount of moisture which it is capable of holding. In practice the amount of air required is many times the figures mentioned above. and the problem of air-drying resolves itself into a question of passing the requisite amount of air through the drying sheds in the shortest possible time; in other words efficient ventilation.

S. Morgan, dealing with manufacture in Malaya (*Preparation of Plantation Rubber*, Morgan and Stevens, p. 180) sums up the position as follows: "It is an elementary point in the study of ventilation problems that the best system of natural ventilation is obtained by admitting cool air near or through the floor and providing an exit for the warmer air at the highest point in the building. It is not often that such a rule is infringed in the ventilation of rubber drying houses....."

"It has already been shown in a previous chapter that one type of drying house, viz., that over a factory—stands condemned, except for the drying of low grade rubbers."

It must be admitted that very few Ceylon drying-sheds conform to the above standards. Our drying rooms are frequently situated over the factory, and it is exceptional to see a roof provided with a ventilating ridge. Fortunately we have a comparatively good climate and on most estates good quality crepe can be prepared without serious difficulties. It is safe to say however that if an average Ceylon drying-house could be transported to the more humid atmosphere of Malaya there would very soon be complaints of off-coloured and spotted crepe.

The first requisite of a drying room is good top ventilation and this is best provided by means of a "jack" roof. The ridge should be raised about 12 inches above the main roof and should have an overlap of 18-24 inches to prevent rain from driving in. Bottom ventilation depends on circumstances. In the case of a loft situated over a packing room or other dry portion of the factory, the windows of the lower room should be kept open, and the floor of the drying room opened up in some way such as replacing floor boards by spaced slats of wood, inserting a number of expanded metal gratings in the floor, etc. It will probably be objected that water will drip into the packing room from the wet crepe but this can be avoided by allowing the piles of crepe to drain before removal to the drying room. As a further precaution hessian can be hung over the part used for packing.

If the loft is situated over the factory proper, air cannot be brought up through the floor as the factory air is saturated with moisture. In the case of a corrugated iron building the walls for

2 ft. above the floor of the drying room should be cut out and replaced by expanded metal, and fitted on the outside with hinged shades to prevent rain from driving in. This cannot be done in the case of a brick or stone building but large ventilators can be inserted at intervals. Air thus introduced at floor level is more useful than that which enters through the windows as it passes up through the rubber from the bottom instead of having to penetrate from the sides. The windows however should be retained in order to get the full benefit of any breeze. In the case of a two-storied drying shed the upper floor should be opened up as described above.

The Writer will be pleased to advise on alterations to existing drying sheds and designs for new ones.

Bulking of Latex.

In the 1st Quarterly Circular for 1927 an account is given of an Experiment dealing with bulking of latex (R. R. S. 1st Quarterly Circular for 1927, p. 10—"Report from the Imperial Institute on samples of Plantation Rubber").

The experiment was carried out at a factory where the latex is coagulated in 10 Shanghai jars. Rubber samples were prepared from latex from each of the jars, and the vulcanising properties of the samples were examined. The various samples were found to be remarkably uniform in properties and the conclusion might hastily be drawn that large scale bulking of latex is proved to be unnecessary.

It should be pointed out however that in this experiment there were certain factors which tend to promote uniformity and that such uniform results could not always be expected.

In the first place, as mentioned in the report, each jar was filled in turn, no attempt being made to separate the latex from different fields. Each jar would therefore contain latex from a number of different fields and this would tend to even up differences in properties of the rubber from different parts of the estate. On some estates latex from different fields is coagulated separately which is very undesirable.

Secondly the estate in question is very uniform in age. All the trees are over 20 years old and it might be expected that the properties of the rubber would be fairly uniform. A similar experiment carried out on an estate composed of fields of varying age would doubtless disclose greater variability of properties.

Further experiments which are now in hand will indicate more clearly whether large scale bulking of latex is necesary in the interests of uniformity.

NOTICES.

INSPECTION OF ESTATES.

Mr. J. Mitchell, Organising Secretary, Rubber Research Scheme, returned from leave on October 4th, and has resumed his duties. He is available for visits to estates to advise on all matters relating to disease control and manufacture.

SUBSCRIPTIONS.

Arrangements have now been made for Bulletins of the Ceylon Rubber Research Scheme to be made available to non-contributors to the Scheme at the rate of Rs. 15-00 per annum, post free.

OFF-COLOURED CREPE.

The Chemist to the Rubber Research Scheme would be glad to get into touch with the Superintendent of any estate who is troubled with off-colour crepe, and who thinks that this may be due to impurities in the water used for manufacture.

GLASS METROLOCS.

Glass Hydrometers for testing latex as specified and as recommended by the Rubber Research Scheme (Ceylon) may be obtained at a cost of Rs. 12-50 each from :—

Messrs. Walker, Sons & Co., Ltd.,
Engineering & Estate Supplies Department,
Colombo.